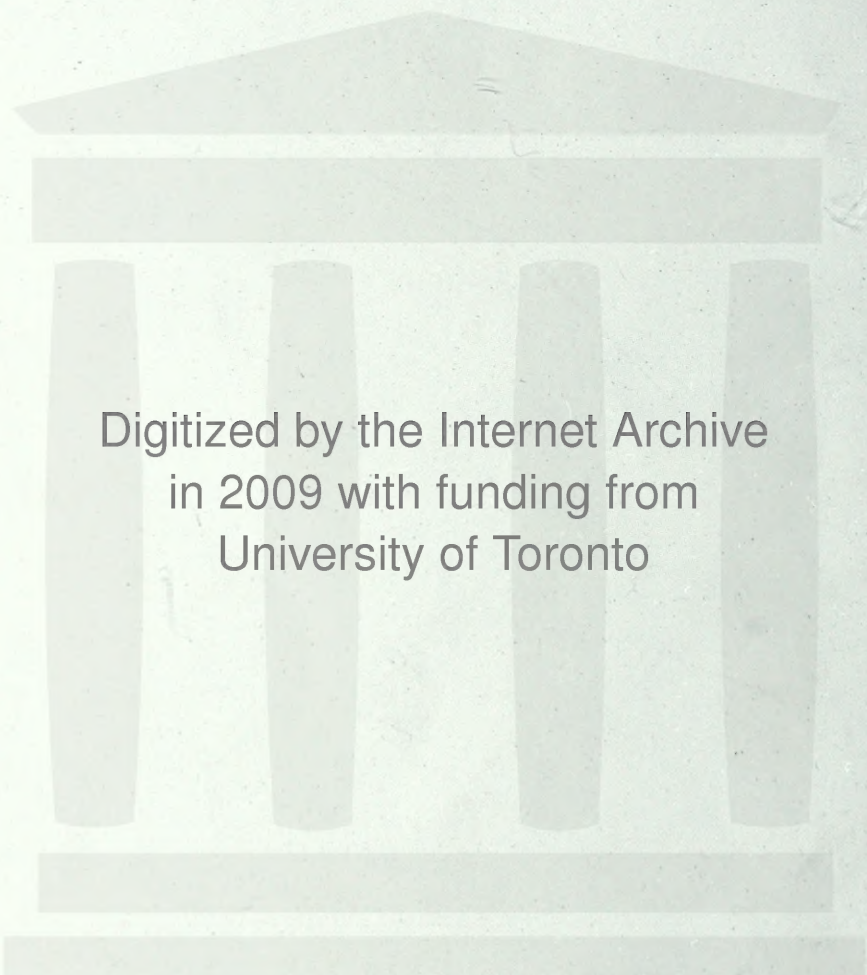

RADIUM

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CHARLES H. VIOL, Ph. D.
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VOL. IV MARCH, 1915 No. 6

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A MONTHLY JOURNAL DEVOTED TO THE CHEMISTRY PHYSICS AND THERAPEUTICS OF RADIUM AND RADIO-ACTIVE SUBSTANCES

RADIUM

A MONTHLY JOURNAL DEVOTED TO THE CHEMISTRY, PHYSICS AND THERAPEUTICS OF RADIUM AND RADIO-ACTIVE SUBSTANCES.

Edited and Published by Charles H. Viol, Ph. D. and William H. Cameron, M. D., with the assistance of collaborators working in the fields of Radiochemistry, Radioactivity and Radiumtherapy.

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THE RADIUM SITUATION IN AMERICA.

CHARLES H. VIOL, PH.D.

Much publicity has lately been given to radium in connection with the radium bills in Congress and the experiments in radium extraction carried out by the experts of the United States Bureau of Mines, working in co-operation with the National Radium Institute. Statements emanating from Washington in regard to these matters have been given the widest circulation, and those interested have spared no effort in a campaign of chicanery to bolster up the above mentioned causes. Many requests have been received by the writer for information in regard to the production of radium in America; the prospect of cheaper radium; and the prospect of securing radium from the Government if Congress should finally pass the "radium bills" which have been under consideration for over a year. In what follows statements will be made which go to show that:

1. The present production of radium in the United States is more than adequate to supply the demand in this country.

2. The selling price of radium is not exorbitant, and the prospects are that the price will rise in time rather than fall.

3. The United States Bureau of Mines has given absolutely no proof whatever that the process for radium extraction said to have been devised by the experts in that Department is at all successful in working up on a large scale the low grade carnotite ore which is at present the visible future source of radium in this country.

4. Should the Government authorize the Bureau of Mines to go into the radium business on the scale contemplated in the acts under consideration, private parties and hospitals would not be able to secure such radium at any price until the National Radium

Institute and the Government Hospitals had been supplied, and to secure such radium would involve waiting about five years.

5. Should the Bureau of Mines be authorized to undertake to produce radium, the result would be to practically confirm the "National Radium Institute" Company in a monopoly of radium for therapeutic purposes for years to come, since the Government Hospitals may each only treat ten patients who are not Government employees and it is evidently the object of the radium legislation to try to make the production of radium a Government monopoly, forcing independent producers of radium to seek a market outside of the United States or else to go out of business.

As far as the writer is aware there are now in the United States two corporations producing radium salts of high purity—the Standard Chemical Company, of Pittsburgh, Pa., and the Radium Company of America, of Sellersville, Pa. As to the output of the latter company no statistics are available. The Standard Chemical Company has produced to date (March 1st, 1915) preparations containing the equivalent of 24,300 milligrams of hydrous radium bromide (13,000 mgm. of radium element) of which the equivalent of 18,000 mgm. of the bromide (9,600 mgm. of radium element) was produced in the year 1914. It had been expected that the output for 1914 would amount to from twelve to fifteen grams of the radium element, but due to the depressing effect of the war abroad and the unproven statements from Washington in regard to cheaper radium on the market, it was necessary to close down the plant for three and a half months. In spite of this curtailing of the output, it totalled 9.6 grams of the radium element.

The carnotite ore worked by the Standard Chemical Company contains from 1 to 2 per cent of uranium oxide, and requires the treating of 400 to 600 tons of ore in order to produce one gram of radium element in the finished product (1.87 grams of hydrous radium bromide). As the quantity of ore treated increases, it will become necessary to treat poorer and poorer ores, and for this reason the cost of production, even on an increasingly larger scale of production, will increase, and the selling price of radium will have a tendency to rise rather than fall.

Radium element or metal at $120,000 per gram is equivalent to pure hydrous bromide ($Ra\ Br_2, 2H_2O$) at $64,320 per gram, since this salt contains 53.6 per cent. of radium element. It is in accord with the decision of the committee on the International Radium Standard, that the Standard Chemical Company sells its preparations on the basis of their radium element content (making the present price $120 per milligram of radium element), rather than on the basis of their equivalent of pure hydrous radium bromide, (a salt rarely sold as a matter of fact) the so-called "radium" of earlier days, which would have a price of $64.32 per milligram of the salt, based on the above price for radium element. By talking of cost of production on the basis of the milligram of hydrous bromide (for which the present selling price is $64.32 per milligram), and comparing their figures on this basis with the present market price of radium element ($120 per milligram),

the Bureau of Mines officials are able to secure very startling comparisons. On this assumption the "radium" at $40,000 per gram produced by the "pencil and paper method," in the Bureau of Mines in 1914, would figure at about $74,600 per gram of radium element. The above mentioned method is always successful in giving very high efficiency, when desired, and actual calculation would show that a gram of the radium element can be produced for about $80,000, if the ore is good quality and production is carried out on a large scale. To develop the market, advertising and sales costs, etc.,—plus a reasonable profit—make the price of $120 per milligram not at all exorbitant. When one considers the enormous sums that must be spent in development of processes for successfully extracting radium, the equipment of concentration plants, etc., and the expenses in developing a market in the face of the hostile conditions which are to be met on every hand, it is not hard to see why capitalists have hesitated to undertake the development of the radium industry. Those who have at great expense and labor succeeded in producing radium and finding a market now face the prospect of losing this market because of these seductive though unproven statements in regard to cheaper radium—which emanate from Washington. The trouble with radium in the United States is not that the radium cannot be had, —or that the price is too high—but rather that the people who should be aware of the value of radium in the treatment of dermatological conditions and malignant growths are not willing to believe the results that are being obtained by those who use radium. Too often the bitterest critics of radium have had no personal experience in the use of radium.

Dr. H. A. *Kelly*, of Baltimore, is one of the pioneer scientific workers in radium therapy in America. He owns more radium than any other individual in America, having between one and two grams of the element. In Baltimore he has an institution where radium is applied for therapeutic purposes. Feeling the necessity of having more radium, Dr. *Kelly*, together with several others, organized the National Radium Institute, a corporation of which he was made president. In the following extracts from the public utterance of Government officials, official reports, and the Congressional Record, the ingenious scheme is shown whereby the National Radium Institute hoped to obtain seven grams of radium bromide for the expenditure of about $150,000. Bureau of Mines experts were to develop a process—supervise the extraction of the radium, etc., from the ore, and if more than the seven grams of radium bromide was obtained, this would go to the Government, together with the process, etc. As an outgrowth of this arrangement, it seemed wise to try to smother the independent production of radium, and to that end bills were introduced for the apparent purpose of conserving the radium deposits of the country by withdrawing from entry all public lands containing this element, and by authorizing the Bureau of Mines to undertake the production of radium.

In an address on "Our Radium Resources," given by Dr. C. L. *Parsons* at the Sixteenth Annual Convention of the American Mining Congress, which met in Philadelphia October 20 to 24,

1913, the speaker announced the co-operative agreement between the United States Bureau of Mines and the newly organized National Radium Institute.

"The National Radium Institute* was incorporated in 1913, with Howard A. *Kelly*, of Baltimore, and James *Douglass*, of New York, as its principal directors. The institute has obtained the right to mine a number of claims in Long Park, near the Paradox Valley, Colo. Under an agreement with the Bureau of Mines, the technical operations of the mines and mill are to be guided by the scientific staff of the Bureau. A plant has been erected in Denver, Colo., where the best methods for treating carnotite ore will be thoroughly tested. Concentration experiments will be conducted in the field, and if successful will be applied to reducing wastes that now take place. After the preliminary experiments, operations will be continued on a larger scale. The institute will study also the separation of uranium and vanadium. All processes, details of apparatus and plant, and general information gained will be published for the benefit of the people."

"The institute has been formed for the special purpose of securing enough radium to conduct extensive experiments in radium therapy with special reference to the cure of cancer; it also expects to carry on experiments regarding the physical characteristics and chemical effects of radium rays."

"The activities of the institute are sure to be of benefit to the prospector and miner by providing a greater demand for ore; to the plant operator by developing methods and by creating a larger market for his product; and to the people by aiding the treatment, and possibly the cure, of the most malignant of diseases."

"The radium produced is intended for the institute's own use and will not be for sale."

In the hearing before the Committee on Mines and Mining, January 19, 1914, on the resolutions Nos. 185 and 186 (the radium bill), Dr. Howard A. *Kelly* said that the plant of the National Radium Institute in Denver would be completed before the end of February, 1914, and that they expected to treat 1000 tons of carnotite ore which were to be mined from claims of the Crucible Steel Company. The Crucible Steel Company was to be paid for 15 per cent. of the ore and was further to receive the uranium and vanadium. The National Radium Institute would receive the first seven grams of radium (bromide) after which the Government would receive any additional radium extracted from the 1000 tons of carnotite ore. Speaking of what the Government would expend in this extraction of the radium Dr. *Kelly* said that the Government would expend nothing, merely supervising the work. As regards a process for extracting the radium from the ore, Dr. *Kelly* admitted that at that time they had none, but that the process would be worked out without expense to the Government.

Repeated requests by members of the Congressional Com-

*Quoted from Bulletin 70, Bureau of Mines, p. 111. A Preliminary Report on Uranium, Radium, and Vanadium, by Richard B. *Moore* and Karl L. *Kithil*, 1914.

mittee for the written agreement between the Bureau of Mines and the National Radium Institute, brought forth promises that the agreement would be made a matter of record. So far, however, it has not been made public.

Quotations from the speech of Hon. Thomas J. *Walsh,* of Montana, (Chairman of the Committee on Mines and Mining, and sponsor of the radium bill in the Senate), in the Senate of the United States, Friday, April 10, and Monday, April 13, 1914.*

"Mr. *Walsh.* I will say to the Senator that I do not recall any testimony given by Dr. *Kelly,* being an estimate by him of the needs of the country. Dr. *Anderson* said that the Government hospitals ought to have from 20 to 30 grams. There are 23 hospitals now operated by the Government of the United States—the Naval hospitals, the Army hospitals, and the Public Health Service hospitals." . . . . . .

Mr. *Walsh.* Mr. President, I wish to say to the Senator that I do not know of any estimate made by anybody as to what the needs of the people of the United States are. I feel entirely satisfied that 30 grams will be nowhere equal to the necessities of the case, because almost if not quite that much is necessary for the Government hospitals, which are limited by law to treating Government employees or those engaged in military or naval service and not more than 10 additional patients." . . . . . "But, Mr. President, one would be entirely in error if he reached the conclusion that 30 grams of radium is believed by anybody to be sufficient to supply the needs of the people of the United States."

"In explanation of the rapid increase in the output of radium, to which reference was made by the senior Senator from Utah (Mr. *Smoot*), I ought to say that the production in this country during the ensuing year is going to be unusually large. Both of the institutions of which I speak—the Standard Chemical Co., at Pittsburgh, and the Radium Co. of America—are new in the field. The latter produced no radium at all prior to the present year, and commenced producing only a month or two ago. Prior to the 1st of January the other company, the Standard Chemical Co., had produced, my recollection is, only about 2 grams, but it is contemplating putting out a gram a month from this time on."

. . . . . .

"Mr. *Smoot.* In that connection I wish to say that Dr. *Kelly* himself said in the testimony as follows:

That is the Standard Chemical Co., of Pittsburgh, and I am sure that they are able to live up to that contract—

That is, one gram per month—

They have been making a splendid quality of radium and delivering full measure."

"Then the doctor goes on to say that the foreign manufacturers, in delivering radium to this country, have not delivered full measure. I wish to say further that Dr. *Kelly* himself said that the Standard Chemical Co., of Pittsburgh, is perfectly able to deliver the 12 grams this year."

Later, after reading into the record a statement by Stephen T. *Lockwood* with regard to Radium Research in America, Sena-

*Congressional Record, January 23, 1915, p. 2357.

tor *Walsh* made the following statements with regard to the process of extracting radium, developed by the Government experts in the employ of the United States Bureau of Mines for the corporation headed by Drs. *Kelly* and *Douglass.**

"Mr. *Smoot.* . . . . . I understand that the Bureau of Mines have a complete process at the present time, and that the Bureau of Mines would not hesitate to let it be known. If that is the case, I thought it would be very enlightening to the American people if we could have that also in the *Record* in connection with the history of this wonderful mineral."

"Mr. *Walsh.* I am very glad the Senator spoke of that, because the process which has been worked out by the Bureau of Mines is now being tried out in a commercial way in reduction works that have been recently completed in the city of Denver. I had intended to speak about that later, and I might as well say now that those works were constructed by an association called the Radium Institute of America. It really consists of Dr. *Kelly,* of Baltimore, and Dr. James *Douglass,* of the city of New York. Dr. *Douglass* is not a surgeon; he is a mining engineer of eminence who is at the head of the celebrated firm of *Phelps, Dodge* & Co. Each of these gentlemen has contributed the sum of $75,000 for the construction of these works, and they are utilizing in them the process which has been worked out by the Bureau of Mines. That process is now undergoing a practical test, and it is the purpose of those gentlemen as well as of the Bureau of Mines to give to the world the details of the method followed just as soon as its efficacy shall have been developed and determined."

Mr. *Henahen,*** in his report as Commissioner of Mines in the State of Colorado, admirably summarizes the views of many in regard to the "radium bills."

"Land-Withdrawal Scheme Injurious to Colorado. We have been mining radium-bearing ores (carnotite and pitchblende) in Colorado since 1888, and the world has paid little attention to the trials and difficulties of the miner in discovering and treating his ores, until December, 1913, when the cry arose in Washington that the radium miner was unpatriotically shipping all his ores out of this country, while thousands of sufferers of that dread disease, cancer, were dying annually in the United States for want of this wonderful element, which our American doctors could not buy. A bill was introduced in Congress to withdraw all radium-bearing lands from public entry, and authorizing the Government to erect a plant for the treatment of all ores mined on public lands, for the use of the army and navy hospitals of the United States."

"When the first news of this legislation reached me through the public press, I saw in it an attempt to destroy an important and growing industry in this state. I realized that it was the entering wedge to a system of leasing all our public lands—the most damnable policy ever concocted against the West. I also saw that the scheme had been carefully worked out, and that the plan was to rush it through on a wave of public sentiment."

*Loc. cit. p. 2361.

**Thirteenth Biennial Report of the Bureau of Mines of the State of Colorado. T. R. *Henahen,* Commissioner. Years 1913 and 1914. Radium Industry, pp. 117-122.

"Behold the picture held up to view of the American people! Reduced to a skeleton, the argument of these philanthropic patriots was as follows:"

"A European radium trust is attempting to gain a corner on all our radium lands. Scientists have proven that there is less than an ounce of radium* in the whole world. When the European trust has cornered all our radium and radium lands, the United States will be helpless. Radium is a positive cure for cancer. Our good friend, Dr. Howard A. *Kelly,* who has made many marvelous cures of cancer with radium, is co-operating with the government, because he believes the government should control this industry. Think of our Army and Navy hospitals lacking this wonderful element, while Europe is taking it all from us! The United States should immediately head off the radium trust by holding these lands. Then we should erect a plant, learn the secrets of manufacture, and do a great philanthropic work. This wonderful element is too precious to be exploited by private capital. It belongs to the thousands of sufferers in the United States, most of whom are poor and cannot afford the present high cost of treatment."

"That good patriot, Dr. *Kelly,* has promised to come to the aid of the government by advancing money for the construction and equipment of a plant for radium manufacture. We must act quickly, or it will be too late."

"Press Agents Busy. Think of this argument being spread by the United States Geological Survey and the United States Bureau of Mines! Sentimental people wept over it, newspapers grabbed at it."

"There is no better publicity service in the world than that of the government bureaus in Washington. These bureaus employ press agents, designated as such, who have the ear of all the influential newspapers in the United States. Recognizing a "good story" and believing the motives of the Government officials disinterested, the correspondents accept their ex-parte statements, when they are backed by much apparent fact. The tactics of the circus press agent were employed to influence the members of Congress."

"Colorado Protests. I called a meeting of the mining men, bankers, and business men of Denver to consider the proposed legislation. The meeting adopted resolutions protesting against the proposed withdrawal of these lands. These resolutions were telegraphed to the Secretary of the Interior. Similar resolutions were adopted by commercial bodies and miners in many parts of the state."

"When the bill came on for hearing before the committee of the two houses of Congress, I appeared as a witness. At those meetings also appeared many mining men of Colorado. Senators

*Referring, of course, to radium in the form of preparations of high purity. A conservative estimate would make the present world's supply of radium element about fifty to sixty grams or nearly two ounces. There is no unanimity of opinion as to the amount of radium which is contained in the Colorado carnotite deposits. As time passes and more claims are developed the estimate increases. Practical miners in the field have estimated the visible radium at more than 2000 grams (over four pounds) so that there seems to be no likelihood of a lack of radium ore. C. H. V.

John F. *Shafroth* and Charles S. *Thomas,* and Representative Edward T. *Taylor,* ably assisted in combating the legislation in committee."

"We were successful in showing that no European radium trust existed; that all the mining companies operating in the carnotite fields were American, financed and controlled by Americans, except one company, which obtained its capital in Europe, but whose officers were Americans—and this company mined only a small percentage of the carnotite ores produced. But even if it had mined a greater percentage, would it have been fair to interfere with its operations? Much of the capital obtained for our gold, silver, lead, copper, and zinc mines comes from Europe. We were glad to get it anywhere. The same is true of capital invested in railroads, street-car companies, and other public works."

"However, when we proved that there was no European radium trust, the friends of the legislation changed their tactics. They now charged that there was an American radium trust, either existing or in the making. The mere fact that there were more than one hundred individuals and companies operating in the fields, and that the carnotite area was thirty times as large as represented, was sufficient refutation."

"Again they changed tactics. They declared that all the ore was being shipped out of the country. I produced railroad records, which showed that 60 per cent of the ore mined was retained in this country and treated here. They charged that radium ore was not successfully treated in this country, but Doctor *Kelly* admitted on the stand that the United Sates produces 'the very best' radium."

"No Monopoly. Next they charged that the company which had the American process would have a monopoly. We assumed that the government believed this company should surrender this process to the public, although it cost $650,000 to produce the first two grams of radium."

"The owner of that process offered to supply the United States government with enough radium for the use of the army and navy hospitals at a price lower than that at which the government could hope to manufacture it. The offer was refused, in spite of the fact that the government had not yet begun to work out a process, did not know how long it would take, or whether it ever would be successful; and in spite of the fact, also, that thousands of people would die meanwhile of diseases which could be helped with radium. Another private corporation was engaged at that time in working out a process. There are several places in Europe where processes have been worked out. It is evident that a monopoly of a process was impossible, and that capital and brains could supply one."

"The price of radium was the next plan of attack, but it was shown by the testimony of government witnesses, under questioning, that the American price of chemically pure radium is considerably lower than the price at which it is sold in Europe."

"It was discovered at the hearing that Dr. *Kelly* was attempting to arrange with the government to build a plant at a cost of

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$300,000, the funds to be furnished by himself and associates, on condition that the government would use the plant to solve a process and in return give him the first seven grams of radium produced. Bearing in mind that radium was then worth $120,000 a gram,* and that scientists had said that there was less than an ounce in the world, the philanthropy of investing $300,000 to receive $840,000 worth of radium in return does not impress me. Talk of radium trusts!"

"Extent of Deposits. But the greatest blow of all was the fact that the United States Bureau of Mines and the United States Geological Survey experts had been maintaining that radium existed only in the Paradox Valley, in Montrose County, Colorado, and a small part of Utah, and that the ore occurred in small pockets, producing a wagon load of ore here and there. I showed that the carnotite area of Colorado then was 150 miles long and five miles wide, extending through Montezuma, Dolores, San Miguel, Montrose, Mesa, Rio Grande and Garfield Counties, and that we were producing hundreds of tons from some claims. I also contended that carnotite ore undoubtedly would be found in other parts of the state, if the prospectors were not interfered with. This prediction has been borne out by developments."

"I maintained and still maintain that there is enough radium in Colorado to supply the world."

"The result of the agitation was that thousands of prospectors took to the field, and in a few weeks discovered carnotite in a total of twelve counties in Colorado. Discoveries also were made in other states. The Canadian government offered a reward to any prospector that would find radium-bearing ore."

"The cry of a radium trust is bosh. Almighty Providence is not in the retail business. There is enough of every element in the world for the use of the world, although we do not readily find it."

"Leasing is Ultimate Object. As stated before, I perceived in this proposed legislation an attempt to place all our mineral lands under a leasing system; and it was not long thereafter that a bill was introduced to accomplish that end. This scheme has been fostered by the bureaucratic heads in Washington for some time, and they have been able to convince a large number of the people of the United States, not familiar with the mining, that it is the only sane plan of conserving our mineral resources. It is the habit of Washington bureaus that they can begin with a desk and a chair and in ten years grow to a building full of offices. If the mines of the West are placed under the leasing system, it means more authority and more jobs for the bureaus. The miner

*In the testimony given before the committees on Mines and Mining, in the House and the Senate, there was a lack of precision in the use of the word radium. Some used the word with the scientific meaning of radium element, while in general the physicians and officials of the government bureaus used the word radium as synonymous with hydrous radium bromide, a loose and unscientific use of the word which is tolerated out of respect to past usage. Bearing this in mind, one can see how even an expert would be puzzled to know whether radium element or radium bromide was meant. As brought out by the testimony, the seven grams are radium bromide. However, the $300,000 mentioned dwindled to $150,000, so that the comparison remains as striking as given here by Mr. Henahen. C. H. V.

is too busy with his work and is lacking in funds to combat the bureau's press agent work. But if any traveler comes from the East, he will be impressed by the fact that our citizens are not all rich, and he must wonder what fools we are, not to be rolling in wealth when there is so much of it lying out of doors, belonging to the government."

"Back of it all is the fine hand of the *Pinchot* type of conservationist, who is so busy looking after the welfare of posterity, and incidentally the building-up of bureaus, and the plaudits and votes of the present generation, that he would hamper the growth of the western states."

"ALL MINERAL LANDS INCLUDED. Analysing the bill, we found that, by a stretch of the imagination, any mineral land could be classed as radium land, since most of our mineral land is radioactive to a degree, and that therefore the government could place similar restrictions on all mineral lands, under the pretense that it was radium-bearing. That the bureaucrats' imagination is susceptible of such stretching is certain, for they have classed as forest reserves 1,814,800 acres of land in Colorado *above the timber line.*"

"I shall not attempt in this article to deal with the leasing question, since it is discussed in another chapter; but I should like to have the reader bear in mind that too much credit must not be given to the efficacy of proposed changes in the government of the public domain, until all sides have been heard. It will be remembered what a furore was created over the proposed radium legislation, and the average reader of the East and South should not be blamed if he believed that the miners of Colorado and other western states were actuated by selfish motives, instead of desiring merely to develop the resources of their home states."

"The following facts should be borne in mind: The radium bills were shelved in committee, although they had strong backing before the Colorado miners appeared with their testimony. Bear in mind that, although a radium plant was being erected by the government in Denver before this bill was introduced nearly a year ago, no process has yet been announced, although it is claimed that announcement soon will be made. Meanwhile the government has not been in the market to buy ores, and the miners would have been compelled to suspend operations until the government plant was ready. Bear in mind that the agitation over this question caused prospectors to be filled with enthusiasm, and to search for the mineral with increased energy before the bill could be passed. Bear in mind that the radium mines of Colorado have not been operating since the European war began, because there is no American market for radium, in spite of the fact that the American manufacturers have used every effort to interest American doctors in it. If, then, there is no market here for it, if doctors will not use it, if many condemn it, how could the United States create a market or fix a price to be paid the miner?"

"WEST SHOULD BE HEARD. It is unfortunate that the western states have not had similar opportunity to be heard on other questions affecting their interests. Radium was a new thing, and therefore interesting. The newspapers and magazines were eager

to get the whole story. Not so with other questions which lack public interest, although important to the West."

"In explanation of the government's going into the radium business, its agents say they desire the radium for government hospitals, and they will furnish five grams of radium to each hospital. There are about twenty-eight such hospitals, this would mean 140 grams of radium metal. If the government plant had a capacity of ten grams of radium metal a year, it would take fourteen years to supply these hospitals. Meanwhile, how are other hospitals and scientific institutions to be supplied?"

"The government-paid employees at Washington may be very good at figuring theoretic values, but they are *not* practical miners, and therefore are not in a position to judge, and we should not be made to suffer from their lack of practical knowledge."

"If private enterprise has thus far furnished all the information we have on the subject, and is now producing the radium faster than the government can hope to, then let private enterprise alone, and it will work out the radium question to the satisfaction of all. Why should the government decide to go into the mining of this ore? Why not go into the mining of gold and silver, or possibly go into other forms of business? Why pick out this particular class of business? Is it because some of the government employees at Washington are desirous of becoming famous as radium investigators?"

"The theory has been advanced that radium is contained in all ores, and it has recently been discovered that ores of gold and silver also contain this rare element. You can therefore see that any person who locates a gold or silver mine, should the proposed law be passed, also will be subject to its provisions. In the event any miner or prospector neglects to work his claim with "due diligence" for four months each year (although he may have to suspend to seek capital), the government would have the right to go upon the property and work it. The miner, according to this plan, would receive the net proceeds from his mine, after the cost of mining and transportation had been deducted. I fear there would be no net proceeds after the government expert payroll had been paid."

Speaking of radium production—Dr. *Holmes,* Director of the Bureau of Mines in his annual report* for the year ending June 30th, 1914, says: "Chemists and engineers of the bureau have demonstrated that a process they have devised for the extraction of radium from its ores can be successfully used on a large scale and will prove more efficient than that used by the largest foreign producers of radium. Through this process it is possible that the cost of radium to the consumer will be reduced to one-third the present price. The process is to be patented and dedicated to the public."

From June until the following January there is a lull. Then on January 27, 1915, we find Congressman *Foster* (Chairman of the House Committee on Mines and Mining and author of one of the radium bills) speaking** as follows in the House: "Mr. Speak-

*Fourth Annual Report of the Director of the Bureau of Mines to the Secretary of the Interior for the fiscal year ending June 30th, 1914, p. 19. "Production of Radium."

**Congressional Record, January 27th, 1915, pp. 2609-10.

er, a year or two ago there was organized the National Radium Institute. Dr. Howard *Kelly* of Baltimore, was elected president, and is still president of the institute. Leases were obtained on carnotite mines in Colorado, from which they are to take out 1,000 tons of ore, and the radium is to be extracted under the supervision of the Bureau of Mines."

"Some time ago it was said before the Committee on Mines and Mining by certain gentlemen who are interested in the business of extracting radium from the ore that the Government would never be able to succeed in its undertaking; that they had no process known for extracting radium that they would be able to demonstrate was successful."

"I am pleased today to say to the Members of the House that under the process which has been put into operation by the Bureau of Mines they have been able to extract the radium from the ore (applause) and I have here a letter from Dr. *Kelly,* president of the National Radium Institute, to Secretary *Lane,* in which he says:

Washington, D. C., January 27th, 1915.

The Honorable the Secretary of the Interior,
Washington, D. C.

My Dear Mr. Secretary:—I herewith gratefully acknowledge, in behalf of the Radium Institute, the receipt from the Director of the Bureau of Mines of 171 milligrams of hydrous radium bromide, to be applied by the Institute to the purposes before planned.

It gives me the greatest pleasure in acknowledging this receipt, and in thus realizing the fruition of our hopes to thank the bureau for the extraordinary success of its labors in thus producing radium by simplified methods to be used for the public good, the entire process being developed in a plant both planned and operated by the Government under the direction of Dr. C. L. *Parsons*, of the Bureau of Mines.

This radium will at once be put into solution and begin its course of beneficient activity in the service of suffering humanity.

With the radium already in our hands, the successful treatment of many conditions has been established beyond peradventure. Many of these cases have been utterly beyond the reach of surgery or other therapeutic measures. We have, however, felt throughout the past months the inadequacy of our supplies to meet the urgent needs in individual cases. We feel, therefore, an entire confidence that the supply now accumulating and heralded by this delivery will enable us to treat successfully conditions up to this time beyond reach.

Very sincerely yours,
Howard A. *Kelly,*
President of the National Radium Institute.

"I might say that by the end of the year 1915 it is confidently expected by the Bureau of Mines that they will be able to supervise the extraction of 7 grams of radium, which Dr. *Kelly* and Dr. *Douglass* desire, and then the Government will secure its share of

the profit in radium which comes from the operation of this plant in Denver, Colo."

"So I congratulate the country upon the fact that the Government has been able to do this work. Especially are we gratified at this time, when we read of so many human lives being sacrificed in war, that there are men like Dr. *Kelly* and Dr. *Douglass* who are willing to give from their private funds $75,000 each and who have lately removed that limit and are willing to furnish more that they may secure this radium for the benefit of humanity and to save human life. (Applause). I cannot too strongly commend the work of these men for the benefit of those who suffer from disease. And I am glad to come to the house today and bring with me this small amount of radium, although it represents a value of $11,000 of this rare metal. I hope that a sufficient quantity of it will be obtained so that it may be placed in the hospitals of our country, where human life may be saved and where those who are afflicted may be saved, and that we may have other ways of curing these diseases without resorting to a surgical operation and which in other cases cannot be done. In this little tube which I hold in my hand there is $5,000 worth of this precious metal, and in the other tube there is $6,000 worth. (Applause)."

Letter of the Washington Correspondent to the Mining Press. February 6, 1915, p. 231. With regard to Radium Production the correspondent writes as follows:

"The House has under its immediate inspection some of the radium which has been produced from Colorado fields, the total amounting to $10,000 in value, and being shown in the House by Martin D. *Foster*, from Illinois, chairman of the House mining committee, to demonstrate what this country could do in radium mining, and especially the Bureau of Mines, which treated the ore by processes of its own at Denver, and at such a reduction in cost that radium heretofore available at $120,000 per gram ought to be salable at $40,000. The Bureau is to make public its processes at a later date. The radium was the property of Howard A. *Kelly*, of the Johns Hopkins hospital at Baltimore, Maryland, and of James *Douglass*, who operates a large cancer institution in the city of New York. These gentlemen supplied the radium from lands owned by them in the West, and it was treated by the chemists of the Bureau at Denver. The cost was defrayed by the United States government out of the annual appropriation of $100,000 for experiments in the treatment of ores. After the gentlemen named shall have obtained seven grams of radium, the radium fields they own are to become the property of the United States, and it is believed that enough radium will be acquired by the government to equal in value the $100,000 appropriated for experimental purposes.* The presentation of the radium in Washington was attended by a banquet at which many felicitations were expressed. Mr. *Kelly* and Mr. *Douglass* declared their faith

*The numerous misstatements in this letter show how difficult it is to get the facts in a case such as is being considered. Naturally an experiment such as the Bureau of Mines is carrying out for the National Radium Institute will cost the government considerable money. It would seem to be a good arrangement for the corporation, but just where the government will profit by the expenditure of its time and money, especially if the radium bills should not be passed, is not so evident. C.H.V.

anew in the therapeutic value of radium, saying that what cancer cures have failed from the application of radium were not due to the use of radium, but to the fact that the cases were such that there was not enough radium on hand to effect the cure. Of course, radium legislation is being held up among others in Congress, and for reasons apart from the filibuster."

Summarizing this data with regard to Governmental production of radium from the more or less contradictory statements cited, the following points are clear:—

1. About October, 1913, the United States Bureau of Mines, with the consent of the Secretary of the Interior, entered into an agreement with the National Radium Institute, a corporation backed by Dr. H. A. *Kelly,* of Baltimore, a man owning a private institution where he has been treating patients by means of radium, and Dr. James *Douglass,* of New York, a mining engineer at the head of the *Phelps, Dodge* & Co.

2. January 19th, 1914, according to Dr. *Kelly,* there was no process worked out by the Bureau of Mines experts to extract radium. The plant of the National Radium Institute would be completed before the end of February, 1914. Here one thousand tons of ore were to be treated, under the supervision of the experts of the Bureau of Mines, without cost to the Government, and from this ore—the National Radium Institute should receive the first seven grams of radium bromide.

3. According to Senator *Walsh*, speaking in the Senate April 10th and April 13th, 1914, it had been estimated that about 30 grams of radium would be required to supply the Government hospitals. The Standard Chemical Company would produce 12 grams of radium element in 1914. The United States Bureau of Mines had at that time developed a process which was undergoing a practical test in the works of the National Radium Institute at Denver, for which work Drs. *Kelly* and *Douglass* had contributed $150,000.

4. Withdrawing the radium lands and production of radium by the Bureau of Mines are not viewed favorably by miners in Colorado, where much of the ore occurs.

5. According to the Report of Dr. Joseph *Holmes*, Director of the United States Bureau of Mines, by June 30th, 1914, the "chemists and engineers of the bureau have demonstrated that a process they have devised for the extraction of radium from its ores can be successfully used on a large scale." By some oversight no mention is made in this report of the agreement made in 1913 with the National Radium Institute to work out a process of extracting radium from the ore, to work up 1000 tons of ore supplied by the Institute in the mill erected by the Institute, nor of the radium which the Government is to receive after the Institute shall have obtained the first seven grams of radium bromide obtained from the 1000 tons of ore.*

*One thousand tons of picked ore would probably average not much better than 2% U_3O_8, and would contain *in toto* about 9500 mgm. of radium bromide. On this basis it would require about 74% efficiency in extraction if even 7 grams of bromide are to be obtained. This is an efficiency that will be difficult to attain, and it is very doubtful whether the Government will ever receive any radium from the 1000 tons of ore.

6. In spite of the success in large scale production, claimed by Director *Holmes,* it is not until January 27th, 1915, *nearly seven months later,* that Mr. *Foster* makes a great stir in Congress about 171 milligrams of hydrous radium bromide, which seems to be the total result of the seven month's effort by the chemists and engineers of the Bureau, using a method for extracting radium that is so cheap and efficient. 171 milligrams of hydrous radium bromide contain 0.0916 grams or 91.6 milligrams of radium element, worth, at the market price of $120 per milligram, $10,992. It would be interesting to know with what efficiency this small amount of radium, apparently representing about seven month's work, was obtained, what grade of ore was used, and what it really cost to actually produce the radium. These important points were not touched on by either Mr. *Foster* or Dr. *Parsons* in their recent utterances. Certainly these results hardly justify belief in the statement that 7 grams of radium (bromide) will be produced by the Bureau of Mines by the end of 1915, and at a cost of $40,000 per gram of radium element, as the statements would lead one to expect. It is a trite saying that Governmental production of anything is notoriously inefficient, slow and expensive. The attitude of those who are seeking to push the radium legislation is very much that of a dog in the manger—"if I don't get to produce radium I'll put you out of business, anyhow." Just where the good to the public is coming is hard to see. The National Radium Institute may obtain its radium—the Government hospitals may in time receive their radium and then after years of waiting—possibly others may also secure radium. Having achieved their object, it is quite likely that excellent excuses will be found for selling at a higher price than $40,000 per gram of radium element, for radium cannot be produced from the low grade carnotite ores at that figure. Throughout, the attitude of the U. S. Bureau of Mines has been antagonistic to radium producers. For their own ends officials of the Bureau were quite desirous of profiting by the experience of the radium producers, but the successes of the latter in preparing radium salts gave the officials of the Bureau little joy. Instead of trying to build up the industry, which promises so much for many unfortunate sufferers, the Bureau has, from the beginning of its interest in radium, minimized the work of the pioneers in radium production, and has sought by all means to discredit them. Premature statements have repeatedly been given out by the officials of the Bureau and these statements have usually been accorded an undue prominence in the daily press, thanks to the efficient publicity bureau which the Bureau of Mines must maintain. If this same attitude were taken by the Bureau towards all the mining industries, it would lead to disastrous results, either to the industries, or to the Bureau.

In conclusion the statements may be reiterated:—

1. The present output of radium in America exceeds the present demand. There is no radium famine.

2. The present price of radium is not exorbitant as has been claimed by some who are not aware of the difficulties of extracting one gram of radium element from 400,000,000 grams

(400 metric tons)* or more of carnotite ore, or by others who have ulterior motives.

3. The United States Bureau of Mines has given no proof whatever that its process is at all successful in the treatment of the low grade carnotite ores on a large scale, and it is these ores which now constitute the visible source of radium in America.

4. Should the Bureau of Mines be authorized to undertake the production of radium and should they succeed in working out a process applicable to low grade carnotite ore, years would pass before private individuals or institutions could secure radium from this source at any price. It is very improbable that any method of extraction will ever make it possible for even the Government to sell radium at $40,000 per gram of radium element.

5. Under the agreement made by the Bureau of Mines with the National Radium Institute, this Company should receive—for a total of $150,000 invested—about 3752 milligrams of radium element. So far seven months work with a so-called successful process has seen an output of about 92 milligrams of radium element. Congressman *Foster,* in the remarks cited, says that Dr. *Kelly* and Dr. *Douglass* have removed that limit ($150,000) and are willing to furnish more that they may secure this radium for the benefit of humanity and to save human life. It would seem that $150,000 had so far produced less than a tenth of a gram of radium, and that more money would be required to secure the balance of the 3752 milligrams desired. With government employees to do the work which outside would require the services of high-salaried experts, with money, plenty of ore, plenty of time, the free services of the bureau press agent, no expense for experimenting in radium therapy, no expense in developing the market, and in spite of the claims made—it is quite evident that the Bureau of Mines has not produced radium for Dr. *Kelly's* Company at $40,000 per gram of radium element.

*The Austrian Government has had a monopoly in extracting the radium from the residues of the Bohemian pitchblende. The pitchblende ores are much richer in uranium than the carnotite ore, the residues from pitchblende containing 200 to 300 milligrams of radium element per metric ton. For years before the discovery of radium the pitchblende deposits had been worked by the Department of Mines of the Austrian Government for the uranium, silver, nickel, and other valuable materials associated with the pitchblende. It was in the residues from this pitchblende that Mme. *Curie* and her co-workers discovered radium. The Austrian Government has sold the radium produced from pitchblende residues at the equivalent of $120 per milligram of radium element. To produce a gram of radium from such material means the handling of only five or six tons of the pitchblende residues. The enormous amount of work in reducing the bulk of material from about 400 tons down to five or six tons, which would be necessary in order to make conditions between radium extraction from carnotite ore and pitchblende residues comparable, work, too, that must be done in extracting radium from carnotite ore, makes the expense of producing radium from carnotite far greater than the expense of producing radium from pitchblende. In spite of richer ore, and a Governmental monopoly, Austrian radium is no cheaper than American radium from carnotite. So much for the advantage of Governmental monopoly. The latest French quotation seen by the writer on hydrous radium bromide, given by the Banque du Radium, is 400 francs (about $80) per milligram. This is equivalent to about $150 per milligram of radium element. Prices for radium in Europe during the first half of 1914 were as high as $186 per milligram of radium element.

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